Claims

It is claimed:

1. A proportional directional control valve comprising:

a housing having a first portion and a second portion, the first portion having an interior chamber;

an electronic controller mounted within the interior chamber;

at least one solenoid assembly electrically coupled to the electronic controller, the solenoid assembly disposed in the second portion, a drive pin of the solenoid assembly being reciprocally moveable responsive to a current provided by the electronic controller;

a valve assembly disposed in the second portion, the valve assembly comprising a linearly moveable valve element operatively connected to the solenoid assembly, a position of the valve element being responsive to a position of the drive pin;

a magnetic assembly operatively connected to the valve element, the magnetic assembly providing a magnetic field responsive to the position of the valve element; and

a magnetic positioning sensor assembly coupled to the electronic controller, the magnetic positioning sensor detecting a change in the magnetic field, the magnetic positioning sensor assembly generating an output voltage proportional to the change in the magnetic field.

2. The proportional directional control valve of claim 1, wherein the current to the solenoid assembly is adjusted by the electronic controller responsive to a comparison of the output voltage and a command electrical input signal.

3. The proportional directional control valve of claim 2, further comprising a main connector coupled to the electronic controller, the main connector configured to receive electrical power and to provide the electrical power to the electronic controller.

4. The proportional directional control valve of claim 3, wherein the main connecter is further configured to receive the command electrical input signal, the command signal electrical input being processed by the electronic controller to drive the solenoid assembly.

5. The proportional directional control valve of claim 1, wherein the first portion and the second portion are substantially easily separable enabling the first portion to be replaced independently from the second portion and enabling the second portion to be replaced independently from the first portion.

6. The proportional directional control valve of claim 1, wherein the magnetic positioning sensor assembly comprises a linear Hall-effect sensor.

7. The proportional directional control valve of claim 1, wherein the magnetic assembly comprises:

a non-magnetic housing having a passageway extending axially through a portion of the non-magnetic housing;

a first magnet disposed in the passageway;

a second magnet disposed in the passageway, a south pole of the second magnet separated from a north pole of the first magnet by a non-magnetic spacer in the passageway; and

a retaining ring disposed in the passageway holding the first and second magnets and the non-magnetic spacer in a fixed position.

8. The proportional directional control valve of claim 7, wherein the non-magnetic housing comprises a beryllium copper housing, and wherein the first and second magnets comprise a samarium cobalt material.

9. The proportional directional control valve of claim 1, further comprising an operator interface port coupled to the electronic controller to enable values for at least one operating parameter of the proportional directional control valve to be downloaded from a set-up device to the electronic controller.

10. The proportional directional control valve of claim 9, wherein the operator interface port comprises a universal serial bus port.

11. The proportional directional control valve of claim 9, further comprising a removable protective cap disposed on the operator interface port.

12. The proportional directional control valve of claim 9, wherein the at least one operational parameter is selected from the group consisting of a solenoid coil voltage, a command input voltage, a command input current, solenoid enable switch, a solenoid null parameter, a solenoid gain parameter, a solenoid acceleration parameter, a solenoid deceleration parameter a dither frequency parameter and a solenoid dither amplitude parameter.

13. The proportional directional control valve of claim 9, wherein the set-up device comprises a computer.

14. The proportional directional control valve of claim 9, further comprising a wireless transceiver coupled to the electronic controller to enable values for the at least one operating parameter of the proportional directional control valve to be downloaded from the set-up device to the electronic controller.

15. The proportional directional control valve of claim 1, wherein the electronic controller is mounted to an electronic board in the interior chamber, and wherein the proportional directional control valve further includes an electronic potting material disposed on the electronic board, the electronic potting material providing a protective barrier for the electronic board.

16. The proportional directional control valve of claim 1, wherein the housing comprises an extruded aluminum chassis.

17. The proportional directional control valve of claim 1, wherein the valve assembly further comprises:

a chamber disposed in the valve assembly;

a source of fluid selectively connected to an input channel of the chamber; and

an output channel in the chamber to selectively convey fluid from the chamber,

the valve element moveable between a first position allowing fluid from the source to be conveyed into the chamber and to the output channel, and a second position preventing the flow of fluid from the source to the output channel.

18. A proportional directional control valve comprising:

a valve operating mechanism that permits communication between a first channel and a second channel through a linear motion of a valve element of the valve operating mechanism;

a magnetic assembly operatively connected to the valve element;

a magnetic positioning sensor assembly operatively coupled to the magnetic assembly; and

a control system controlling a linear movement of the valve element in response to an electrical signal generated by the magnetic positioning sensor.

19. The proportional directional control valve of claim 18, wherein the valve operating mechanism further comprises at least one solenoid assembly electrically coupled to the control system, a drive pin of the solenoid assembly being reciprocally moveable responsive to a current provided by the control system.

20. The proportional directional control valve of claim 19, wherein the control system comprises:

a micro-controller mounted within an interior chamber of a first portion of a housing of the proportional directional control valve;

a operator interface port coupled to the micro-controller; and

a set-up device communicatively coupled to the operator interface port.

21. The proportional directional control valve of claim 20, wherein the set-up device comprises a computer.

22. The proportional directional control valve of claim 20, wherein the control system further comprises a wireless transceiver coupled to the micro-controller.

23. The proportional directional control valve of claim 20, further comprising a main connector disposed at a second end of the first portion and coupled to the micro-controller.

24. The proportional directional control valve of claim 20, further comprising an electronic potting material disposed on the micro-controller.

25. The proportional directional control valve of claim 18, wherein the valve operating mechanism and the magnetic assembly and the magnetic positioning sensor are disposed in a second portion of the housing, and wherein the first portion and the second portion are separable.

26. The proportional directional control valve of claim 18, wherein the magnetic positioning sensor assembly comprises a linear Hall-effect sensor.

27. The proportional directional control valve of claim 18, wherein the magnetic assembly comprises:

a non-magnetic housing having a passageway extending axially through a portion of the non-magnetic housing;

a first magnet disposed in the passageway;

a second magnet disposed in the passageway, a south pole of the second magnet separated from a north pole of the first magnet by a non-magnetic spacer in the passageway; and

a retaining ring disposed in the passageway holding the first and second magnets and the non-magnetic spacer in a fixed position.